SCIENCE

VOL. 84 FRIDAY, OCTOBER 23, 1936 No. 2182

The School of Horticulture in Perspective: DR. C. STUART GAGER 357

Obituary:

Kurt Walter Franke, 1889–1936: DR. ROSS AIKEN GORTNER. *Recent Deaths and Memorials* 365

Scientific Events:

The Medical Curriculum in Great Britain; The Control of Forest Fires; The Fossil Cycad National Monument; Child Neurology Research 366

Scientific Notes and News 369

Discussion:

On the Structure of Chromosomes: PROFESSOR EDWARD C. JEFFREY. *The Rôle of Kinesthesis in Maze Learning:* DR. C. H. HONZIK. *The Dates of Publication of the Earlier New York State Museum Reports:* DR. RUDOLPH RUEDEMANN. *A New Word:* PROFESSOR GLOVER M. ALLEN 372

Scientific Books:

The Philosophy of Mathematics: SAUNDERS MAC-LANE 374

Special Articles:

Perfection and Agglomeration of Crystalline Precipitates on Aging: PROFESSOR I. M. KOLTHOFF. *Uterine Response to Dihydrotheelin:* H. W. MARLOW. *The Vitamin C Content of the Human Tonsil:* DR. MARY M. CLAYTON and JOHN D. KEITH. *Cytogenetic Notes on Cotton and Cotton Relatives. II:* DR. J. M. WEBBER 376

Science News 6

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL and published every Friday by

THE SCIENCE PRESS

New York City: Grand Central Terminal

Lancaster, Pa. Garrison, N. Y.

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary, in the Smithsonian Institution Building, Washington, D. C.

THE SCHOOL OF HORTICULTURE IN PERSPECTIVE[1]

By Dr. C. STUART GAGER

DIRECTOR, BROOKLYN BOTANIC GARDEN

SIR WILLIAM TEMPLE, British statesman and author, was born in 1628 and died in 1699. Soon after his marriage, at the age of 27, he took up his residence in Ireland, where he is said to have "read a good deal and acquired a taste for horticulture."

In 1692 appeared the second part of Sir William's essays—the "Miscellanea," which included his classical essay on gardening.

"As gardening has been the inclination of kings and the choice of philosophers," said Sir William, "so it has been the common favourite of public and private men; a pleasure of the greatest and the care of the meanest; and, indeed, an employment and a possession for which no man is too high nor too low."

When Sir William died he was buried by the side of his wife in the south aisle of Westminster Abbey. But, by special instructions, his heart was buried, not by the side of his wife, but in a silver box under a sun-dial in his garden, opposite his favorite window seat. So much affection can one have for a garden!

Having learned, from this incidence, the relative regard in which Sir William held "ladies" and gardens, we may not, perhaps, be greatly surprised that he writes as follows:

"I will not enter upon any account of flowers, having only pleased myself with seeing or smelling them, and not troubled myself with the care, which is more the ladies' part than the men's." And then he concludes, "but the success is wholly in the gardiner"—who, of course, was a man. Perhaps if there had been a school of horticulture for women in Sir William's day this last disparaging sentence could, or perhaps would, not have been written.

[1] Address delivered at the twenty-fifth anniversary exercises of the School of Horticulture for Women, Ambler, Pa., May 20, 1936.

BOOKS ON PLANT LIFE FOR "LADIES"

It is interesting to note the persistence with which this idea of the study of flowers being "more the ladies' part than the men's" appears in botanical literature. As early as 1717 the great diarist, John Evelyn, published in London a book of some 200 pages entitled, "The Lady's Recreation, or the Third and Last Part of the Art of Gardening Improved."

The only work of the great French philosopher, Rousseau, devoted to plant life was entitled "Letters on the Elements of Botany Addressed to a Lady." The English translation, by Thomas Martyn, was published in 1771—54 years after Evelyn. J. Reynolds Green tells us that only the introduction and eight of the thirty-two letters were from Rousseau's pen, the remainder being original with Martyn.

Some of us will always be grateful to Rousseau for one of his statements: "I have always believed," he said, "that one could become a very great botanist without knowing the name of a single plant"!

"Before we teach our children to name what they see," says Rousseau, "let us begin by teaching them how to see. This science, which is forgot in all sorts of education, should make the most important part of it." An echo of "Emile."

As illustrating the difference in the point of view of the botanist and the horticulturist, we may note Rousseau's statement (or is it Martyn's?) in letter VII that "The double flowers, which we admire so much in our borders and beds, are but monsters, deprived of the power of producing their like. . . . Whenever you find them double do not meddle with them, they are disfigured; or, if you please, dressed after our fashion: nature will no longer be found among them."

I must confess that, while I greatly admire double roses and double peonies—when I think of double sweet peas, double daffodils and double nasturtiums, I feel more or less in sympathy with Rousseau.

Twenty years after Rousseau's work, the noted English botanist, John Lindley, published in London (1841) his well-known book, frankly entitled, "Ladies' Botany." Aside from the title, however, there is little in the book to suggest that it was intended exclusively or even primarily for ladies.

John Ruskin, in his book on botany, "Proserpina," published in England in 1878, refers thus to Lindley's work: "I return . . . to a book I gave away long ago, and have just begged back again, Dr. Lindley's 'Ladies' Botany.' For without at all looking upon ladies as inferior beings, I dimly hope that what Dr. Lindley considers likely to be intelligible to *them*, may be also clear to their very humble servant." Ruskin, contrary to Lindley, nowhere states that his book is intended primarily for ladies, but there is internal evidence that it was.

BOOKS ON PLANT LIFE BY WOMEN

I am sure it will surprise most of my hearers, as it did me, to learn that one of the earliest known manuscripts on plant life was by a woman. This was the "Physica Elementorum, fluminum aliquot Germaniae, metallorum, leguminum, fructuum, herbarum" (citing only the short title), written about the year 1180 by Hildegard of Bingen, and first printed at Strassburg in 1533. Hildegard was a Benedictine nun of great learning, and is called by Sarton "one of the leading scientists and one of the most influential personalities among Christians of her time."

It was about 550 years after Hildegard (in 1737) that another woman, Elizabeth Blackwell, who lived with her husband opposite the Physic Garden at Chelsea, England, wrote a two-volume work entitled, "A Curious Herbal." In the same year it appeared with a Latin title, and also in a German translation. This is one of the earliest modern records of a professional interest in horticulture on the part of women.

More than one hundred years elapsed before we find the next gardening book by a woman. In 1841 Mrs. Jane Webb Loudon published "The Ladies Companion to the Flower Garden, being an alphabetical arrangement of all ornamental plants usually grown in gardens and shrubberies: with full directions for their culture."

It is in this book by Mrs. Loudon that we find one of the early clear statements of the advantage of the cooperation of the landscape architect and the practical gardener. For their combined labors she adopted the term "Landscape Gardening," "because the art can only be advanced and perfected by the united power, of the *landscape painter* and the *practical gardener* . . . the luxuriant imagination of the *painter* must be subjected to the *gardener's* practical knowledge of planting, digging, and moving earth." She quotes a French couplet:

> Ce noble emploi demande un artiste qui pense
> Prodigue de génie, mais non pas de dépense.

In 1829, there was published at Hartford, Connecticut, an elementary text-book with the title, "Familiar Lectures on Botany," by Mrs. Almira H. Lincoln. Although nothing is said on the title page that the book is intended primarily for ladies, the "authoress" tells us in her preface that the book is based upon a "sketch" which she prepared for the use of her pupils in the Troy Female Seminary. This is, perhaps, the first American book on plant life by a woman.

FROM GUESS-WORK TO SCIENCE

Theophrastus (370–285 B.C.), in his "Enquiry into Plants," made a promising start toward a science of horticulture, describing cultivated (as well as wild)

plants, both trees and herbs, and giving fairly detailed instructions for planting, cultivating, fertilizing, et cetera. But his instructions were often merely the expression of an opinion, and throughout his work, we continually run across such expressions as "some say" this, but "others say" that. Thus, in Book VII, treating of pot-herbs, he notes that rain water is good for onions, but "some, however, say that rain water is not good for melons nor for onions."

The Spanish writer on agriculture, Lucius Columella, of Cadiz, flourished in the first century A.D. and was a contemporary of Nero, Seneca and Pliny, and of Diosconides, the greatest botanist of his time. In the preface to his twelve books, "De re rustica," Columella was one of the first to call attention to the general neglect of agriculture as a profession, in comparison with other human interests and arts.

> I cannot enough wonder [he says] why they, who desire to learn eloquence, are so nice in their choice of an orator, whose eloquence they may imitate . . . and they, who are desirous of some skill in dancing and music, are exceedingly scrupulous in their choice of one to modulate their voice, and teach them to sing agreeably, and no less a dancing master, to regulate the gestures and motions of their body . . . and, not to mention every particular, in that study which every one resolves to prosecute, he makes use of the wisest and ablest director he can find; finally, every one sends for a person from the society and assembly of the wife, to form his mind, and instruct him in the precepts of virtue: but Husbandry alone, which, without all doubt, is next to, and, as it were, near akin to wisdom, is in want of both masters and scholars . . . I myself have seen . . . academies . . . for delicately dressing and seasoning of victuals, for contriving and making up costly dishes . . . and I have also seen headdressers and hair trimmers [home economics and beauty parlors in the first century A.D.!]; but of agriculture, I have never known any that professed themselves either teachers or students.

And so horticulture continued to be an art without any underlying science until about the middle of the nineteenth century, when the first colleges of agriculture and agricultural experiment stations began to be established (Rothamsted, 1843).

One could not even outline the history of horticultural education in one address, but two or three high spots should be cited.

Thomas Martyn, as editor of Philip Miller's "The Gardeners and Botanists Dictionary," says that Evelyn's "Sylva Sylvarum" (1664) made a new era in gardening. He is also authority for the statement that "The first considerable treatise on ornamental gardening is Mr. Wheatley's entitled 'Observations on Modern Gardening,' published anonymously in London in 1771."

In this country, agricultural education began to be organized about the middle of the nineteenth century. One of the first steps was the giving of lectures on "agricultural science" at the State University of Michigan in 1853. The Michigan Agricultural College began to give instruction in 1857. Horticulture was first developed as a separate subject in Michigan Agricultural College in 1867. The Society for Horticultural *Science* was organized in September, 1903.

The First American Women Students of Horticulture

On August 12, 1851, the People's College Association was formed at Lockport, New York, and adopted a prospectus of studies, including "those sciences most immediately and vitally essential to agriculture and the useful arts." At one of the subsequent meetings of this association, Lucy Stone and other ladies attended in order to make sure that women should have equal rights with men in the proposed college!

In his book, "The Mediaeval Mind," Henry Osborn Taylor has tersely said: "Nothing passes away, and very little quite begins, but all things change." If we keep this in mind and are not too meticulous as to just what it was that these ladies at Lockport studied, we shall probably not be far from the truth in stating that Lucy Stone and her "female" companions were the first women students of horticulture in America—85 years ago.

What is Horticulture?

But what is horticulture? The word seems to have first appeared in 1678 in the Appendix of the fourth edition of the "New World of Words or General Dictionary," by Edward Phillips, nephew of John Milton and educated by him. The word horticulture was admitted into the French language by the Académie Française in 1835—almost exactly 100 years ago. So new are some things which seem to us to have existed "always"!

Robert R. Livingston, of New York, a member of the Continental Congress, defined horticulture as "an elegant branch of husbandry." Just as horticulture is a subdivision of agriculture, so horticulture itself, as every graduate of Ambler knows, may be subdivided into branches.

Professor Bailey, in his Standard Cyclopedia, names four subdivisions: Pomology, or fruit growing; Olericulture, or vegetable gardening; Floriculture, the raising of ornamental plants; and Landscape Horticulture, or the growing of plants for use in landscaping.

So busy were the early settlers of this country endeavoring to get a bare living out of the soil that horticultural activity was at first largely confined to pomology and vegetable gardening. It is gratifying to know, however, that the esthetic urge is so strong in human beings that plants that are "merely" orna-

mental *will* get grown. As Bailey points out, the growing of ornamentals and their use in landscaping accompanies "the deepening of the home life." How appropriate, therefore, that there should be a school of horticulture for home-makers—for women. It seems strange that the establishment of the first such school took place so recently as only twenty-five years ago.

Recalling the reputation of Americans for being "practical" even to the extent of being primarily commercial in their enthusiasms, it is of interest to note that floriculture has become the most important branch of horticulture, judged by the number of species and varieties of plants that are grown and by the number of persons interested. In this connection, there comes to mind a pertinent passage from Victor Hugo. The Bishop is conversing with Madame Magloire, in "Fantine":

> The garden, which had been rather spoiled by the ugly buildings which have been mentioned, was composed of four alleys in cross-form, radiating from a tank. . . . These alleys left behind them four square plots rimmed with box. In three of these Madame Magloire cultivated vegetables; in the fourth, the Bishop had planted some flowers . . . Madame Magloire had once remarked, with a sort of gentle malice: "Monseigneur, you who turn everything to account have, nevertheless, one useless plot. It would be better to grow salads there than bouquets." "Madame Magloire," retorted the Bishop, "you are mistaken. The beautiful is as useful as the useful." He added after a pause, "More so, perhaps."

When we consider what a major rôle garden vegetables play in our diet—for nourishment, which we tolerate; for roughage, which we need; for variety, which we crave; for calories, which we avoid; and for vitamins, which we must have, it seems strange that vegetable gardening has been the last division of horticulture to become organized and commercially important in America.

The early economic importance of pomology in America, standing easily first, in this respect, of the four branches of horticulture, is perhaps due to the fact that outstanding success with a large diversity of fruits has been insured by a diversity of favorable climates—New York and Oregon for apples, California and Florida for citrus fruits, and so on. In looking over the catalogs of our very early nurseries, one is struck at once with the great variety of fruits which were listed for sale.

The Prince Nursery, at Flushing, L. I., was established about 1727. The 22nd edition of its catalogue, published in 1823, "Practical horticulture being in that day quite a novelty in America" (as the preface states), lists 90 kinds of grapes, 114 apples, 107 pears, 53 cherries, 74 peaches, 48 plums, 55 gooseberries, 254 roses and 330 ornamental trees and shrubs.

The 1829 catalogue of the commercial garden of André Parmentier, established in Brooklyn in 1825, offers 12 kinds of table grapes, 242 kinds of apples, 190 kinds of "superior pears," 71 cherries, 64 peaches, 85 plums, 20 gooseberries, 396 kinds of trees and shrubs, besides 200 kinds of roses—a truly impressive assortment for that early date.

There is hardly a nursery in America to-day that carries a larger number of varieties. In fact, lack of variety is one of the weaknesses of present-day commercial horticulture in this country. To establish this fact one has only to compare the nursery catalogues of America with those of England and Europe. What American nurserymen seem most interested in is orders for carload lots of one or a few varieties not troublesome to grow in the nursery and easy to ship. Of course the nursery business is a business, not a philanthropy, and it must yield profits. But may we not hope that increasingly in the future we shall be finding a richer variety of ornamentals listed in American nursery catalogues, and may be able to secure them, even though we wish only one or two of each?

The Historical Setting for Ambler

It is significant that the first independent school primarily for horticulture in America is located in Pennsylvania, for that is a state where things have had a way of happening first. If we regard the Declaration of Independence as the beginning of the United States, then the United States happened first in Pennsylvania.

But, as Osborn Taylor said, "very little quite begins." It is often extremely difficult to fix upon an exact date or a definite event as the actual and clear-cut beginning of great or important movements or institutions.

However, avoiding controversial questions, several agricultural and horticultural events appear to have occurred first in Pennsylvania. In this state agriculture was first organized in America with the establishment in 1785 of The Philadelphia Society for Promoting Agriculture. (The Agricultural Society of South Carolina was organized in the same year.)

Pennsylvania is the state where David Landreth, soon after 1784, founded one of the first commercial seed establishments in America.

American horticulture appears to have been first organized in New York with the formation of the now defunct New York Horticultural Society in 1818. This was not the same organization as the present Horticultural Society of New York (1900, incorporated, 1902). But Pennsylvania was second with the organization of the Pennsylvania Horticultural Society in 1827. The Pennsylvania society of to-day is the original one, and would seem, therefore, to be the

oldest one in the country; moreover, it is to be credited with inaugurating the first annual flower show in the fall of 1830.

Not only was agriculture first organized in Pennsylvania, but the first botanic garden in America was also probably established in the same state, and not far from Ambler. Of course you are all thinking of Bartram's garden, begun in 1728. The article by Gager on "Botanic Gardens" in the "Standard Cyclopedia of Horticulture" credits Bartram's garden as the first botanic garden to be established in America. But it appears that Gager was wrong about this, for Professor Harshberger, in an article in the *Pennsylvania Magazine of History and Biography,* in October, 1924, records the fact that the first "botanic garden" in Pennsylvania (and therefore probably in America) was that of the Rosicrucian fraternity on the lower Wissahickon. This was really a medicinal plant garden. Harshberger further states that the second garden was that of Christopher Witt, at the southeast corner of High and Main Streets, in Germantown, antedating Bartram's garden by about 20 years. These two gardens, however, do not appear to have had the importance for botany and horticulture that attaches to Bartram's garden.

We can only refer to the facts that Bartram's cousin, Humphrey Marshall, established his botanic garden at West Bradford in 1773, and that William Darlington, about 1850, developed the public park at Westchester as a small arboretum of native trees.

And so we see that the School of Horticulture for Women is part of a great tradition. Environment would seem to be quite as significant for institutions as for plants.

With this historical background in mind, it has seemed to me it would be pertinent on this occasion to note a few of the horticultural developments that have taken place, wholly or partly, within the lifetime of Ambler.

Botanic Gardens

The term "botanic garden" was first applied merely to the plantations themselves—to the garden. The modern botanic garden, as a scientific and educational institution, comprises not only the plantations, with various types of gardens and horticultural collections, but includes as well a program of scientific research and public education organized around and upon these collections and plantations, supplemented with herbaria, library, laboratories, lecture rooms and classrooms, and carried on by a scientific, educational and administrative staff.

The evolution of the botanic garden from merely a plantation to such an institution has probably made more progress during the lifetime of Ambler than in any previous period of that length, and this may be considered as one of the important horticultural movements of the past quarter century. The development of an effective program of juvenile and adult education by botanic gardens is still in its infancy.

Nearly every city in the Old World has a botanic garden. America has still a long way to go before it reaches that record, but I am sure you will be as surprised as I was to learn that, if we include Brooklyn, established in 1910, there have been no less than twenty-two botanic gardens established in the United States during the existence of Ambler. Most of these came into existence during the past ten years.

Rock Gardening

The original plans for the plantations of the Brooklyn Botanic Garden included a Rock Garden. The construction work was completed and the first planting done in May, 1916. So far as we can ascertain, this was the first genuine rock garden in a public park or garden in America. By "genuine rock garden," I mean a garden of alpine and saxatile plants in proper setting and not merely a flower garden with rocks in it. The distinction between the two is not always kept in mind.

It is a pleasure to note at this time and place that this first public rock garden was constructed and developed under the general supervision of Mr. Montague Free, formerly instructor at the School of Horticulture. Ambler, therefore, shares with Brooklyn the honor of Mr. Free's election as the first president of the American Rock Garden Society, organized in 1934. Interest in rock gardening has spread and several rock gardens have been constructed during the period of Ambler.

Garden Clubs

A horticultural movement, largely within the past 25 years, peculiar to America and of special interest here, is the development of garden clubs. This is of interest to a school of horticulture for women because most of these garden clubs are of women.

For some time, it was believed that the Philadelphia garden club, formed in 1904, was the oldest one in America, sharing honors with the Minnesota Garden Flower Society, a true garden club, formed the same year. I am sorry that I can not, at this time, and place, credit the honors closer to Ambler, but Mr. Farrington, in an editorial in *Horticulture* for November 1, 1931, calls attention to the fact that the Massachusetts Horticultural Society awarded a medal to the Cambridge Plant Club in recognition of the fact that it appears to be the first, or at least the oldest, garden club in America. The first meeting of this club was held 47 years ago on January 20, 1889.

I am happy, however, to record the fact here that the Philadelphia Garden Club took the first steps in

the formation of the Garden Club of America. I quote from Mr. Farrington's editorial.

> The Philadelphia Garden Club's first meeting was held on May 19, 1904 [almost 32 years to a day], at the home of Mrs. Charles Biddle in Andalusia, Pennsylvania. Mrs. Stuart Patterson was made the first president and gave so much time and thought to the garden club movement in later years that she became known as the "Mother of garden clubs." It was she who called a meeting in 1913 [well within the Ambler quarter century] which resulted in the birth of the Garden Club of America.

The formation of the Garden Club of America gave a great impetus to the garden club movement, and soon the formation of state federations began. There are now more than 30 federations, that of Virginia, organized in 1920, appearing to be the oldest.

In 1929 the National Council of State Garden Club Federations was organized in Washington, D. C. There are now 1,980 federated clubs represented in the council, with more than 100,670 individual members in 36 states. According to a list of June, 1935, issued by the U. S. Bureau of Plant Industry, there are 281 horticultural organizations in the United States. Eight of these are in Pennsylvania.

Special-Flower Societies

Organizations based upon special interest in different animals are well known in the zoological world. A bull-dog society, an airedale club, a toy-dog association and others hold animal exhibitions under the auspices of the Westminster Kennel Club. There are bird-lovers clubs, the Audubon Society, aquarium societies, a cat society, even a reptile association.

I have been surprised to find how recent is the organization of flower lovers in America about special interest in a single genus. That the rose easily outdistances all other flowers in popular interest is reflected in the fact that the first special-flower society in America appears to have been the American Rose Society, organized in 1899—12 years before Ambler. The incorporation of this society, however, did not occur until July, 1921.

The American Peony Society, as an incorporated organization, antedates both Ambler and the American Rose Society, having been formed in 1903 and incorporated in 1904.

Among special-flower societies formed within the Ambler period may be mentioned the following: American Sweet Pea Society (1909 or 1910); American Fern Society, 1910 (previously functioning as the American Fern Chapter); Gladiolus Society, May 27, 1910; Dahlia Society, 1915; Iris Society, 1920; American Orchid Society, 1921; Delphinium Society, 1926; The Cactus and Succulent Society, 1929; Amaryllis Society, 1933.

Horticultural Periodicals

Important items in horticultural publication during the Ambler period are the establishment of *The National Horticultural Magazine* in 1921, and the transformation of the journal, *Horticulture*, from a trade paper to become the official organ of the Massachusetts Horticultural Society with its issue of August 1, 1923. The first series ceased with the issue of July 25, 1923. Later, as we all know, *Horticulture* became also the official journal of the Pennsylvania and the New York Societies.

Volume one of the *Bulletin* of the Garden Club of America appeared in 1913, and the *Garden Digest*, of the Federated Garden Clubs of New York, was launched in 1930.

Contributions of Pure Science to Horticulture

Students and alumnae of Ambler do not need to be reminded by me of the new ideas and methods of propagation and culture that have been proposed and some of which have become current practice since 1911. Three may be mentioned:

All arts and all applied sciences always benefit from the results of research in so-called "pure" science. One of the outstanding contributions of botany to horticultural practice has been the discovery of photoperiodism by Garner and Allard, as reported in their paper on the "Effect of Relative Length of Day and Night and Other Factors of the Environment on Growth and Reproduction in Plants," published in the *Journal of Agricultural Research*, March 1, 1920.

The results of research in plant genetics during the past 25 years have extended the pioneer work of Mendel and have made possible more intelligent and more efficient procedure in the breeding of new varieties of vegetables and flowering plants.

The diffusion of the conception represented by the term "clone," introduced by H. J. Weber in 1903, has also been of help in practical plant breeding.

From Amateur to Professional

American horticulture in its early stages was largely influenced by the work of amateurs, but during the past 25 years the development of the commercial side of horticulture has been accompanied by a steadily increasing amount and importance of professional scientific work. In 1927, in our state agricultural colleges and experiment stations, there were nearly 2,000 research projects devoted to horticulture. To-day, there are more than 1,000 such projects.

The past quarter century has not only seen the expansion and enrichment of horticultural work in older institutions, but also the establishment of such privately endowed institutions as the Brooklyn Botanic Garden (1910), the Boyce Thompson Institute

for Plant Research (1921), the Arthur Hoyt Scott Horticultural Foundation at Swarthmore (1929) and others. A Museum of Horticulture, as a permanent educational institution, is being established this year by the city of Dallas, Texas.

New Varieties Introduced

Until our attention is called to it, we do not realize how small a number of species of wild plants have yielded horticultural forms. The actual number of species of plants is not known, but it has been estimated that more than 500,000 species of flowering plants and ferns have been described.

Since the School of Horticulture was founded, systematic botanists (in the period of 1910–1935) have described no less than 118,700 species—an average of 4,750 species each year. How many of these shall prove useful in horticulture remains largely to be seen. Doubtless some of them will.

The Division of Plant Introduction of the U. S. Department of Agriculture has brought into the United States about 80,000 kinds of plants during the past 25 years. How many of them are known to those in this audience? How many of them are now of commercial importance?

Among the more successful introductions might be mentioned the Korean chrysanthemums, dwarf Michaelmas daisies, *Kolkwitzia amabilis,* some of the day-lily hybrids of Stout and of Betscher, varieties of Japanese cherries and newly introduced Japanese iris (not yet in the trade). The first collection of bulbs of the regal lily was made in 1910, so that its actual appearance in trade falls within the past 25 years.

When we realize of how few really important new varieties the past 25 years can boast, we recall with renewed and deepened admiration the wonderful performance of the great French breeder, Victor Lemoine. Judged by the number of his novelties and also by their value to the gardens of the world, he is easily the greatest plant breeder of all time. As every horticulturist doubtless knows, it was he who produced (in 1876) the first double lilac. "Not a person who grows plants in a garden but what at one time or another has handled something that was the product of this master craftsman." Victor Lemoine died in the year when Ambler was founded.

New Practices and Skills

One would hardly think that the introduction of the automobile would influence horticultural practice; but the increase in the number of motor vehicles has been accompanied, as we know, by a corresponding decrease in the number of horses, and this, in turn, has resulted in the comparative scarcity and higher price of manure. This has been compensated for, in part, by the more general use of native and imported peat moss. Twenty-five years ago it was hardly a commercial commodity in America.

Among other new practices, perfected since the founding of Ambler, may be mentioned improved methods in stratification of seeds at low temperatures during their "after-ripening" period, to insure a high percentage of germination; the use of other media than sand for the insertion of cuttings; the stimulation of root-formation in cuttings by treatment with various chemicals; aseptic methods of germinating orchid seeds; the growth of lilies from seeds by amateurs as well as professionals; and the growth of potatoes and other vegetables as crops in aquatic nutrient solutions and in sand watered with nutrient solutions.

In 1911 the use of Terraria—glorified Wardian Cases—was almost unknown. Their general use dates from 1922, the year in which the Brooklyn Botanic Garden *Leaflet* on "The Wardian Case" was published.

Flower Arrangement

"Short is the bridge connecting gardening and flower arranging." So writes Mary Averill, of the Brooklyn Botanic Garden, pioneer missionary of this art, who introduced America to the methods and beauty of Japanese flower arrangement. In Japan the art is centuries old, with rigid rules and even with religious significance—something otherwise entirely unknown as a highly developed art in America.

But the introduction of courses of instruction in general flower arrangement, not restricted to the Japanese manner, falls well within the Ambler period. A course in flower judging was offered by the Federated Garden Clubs of New York State in 1931, in connection with the annual International Flower Show in New York City, and this was one of the first, if not the first, course of its kind in America. But here the emphasis was upon the judging of arrangements already made and offered in competition.

In January, 1933, the Brooklyn Botanic Garden offered a course of instruction in Japanese and other methods of flower arrangement, given under the auspices of the woman's auxiliary of the garden. The response to this opportunity was so enthusiastic that the course has been repeated every winter since, with a large registration each year.

In this connection, we may note that the first American books on flower arrangement (other than Miss Averill's books on Japanese flower arrangement) also appeared in 1933.

Plant Patents

Packages for shipping plants have been patented; also fertilizers and methods of grafting and of "tree

surgery," so called. Plant patents are primarily to insure to the breeder the commercial advantages of his work. If Ephriam Bull could have patented the Concord grape in 1849, or if William Saunders, who introduced the Washington, or Bahia, navel orange in 1870, could have patented that, the financial returns might have been as great as from the invention of motion pictures or automobiles.

The first plant patented was "a climbing or trailing rose," an improvement on the "Dr. Van Fleet," characterized by its ever-blooming habit and called the New Dawn. This patent was issued on August 18, 1931.

The patents that have been issued cover almost every conceivable characteristic of plants, such as color, shape, vigor, fragrance, flavor, canning and shipping qualities, size of seed, absence of seeds, keeping quality of flowers, resistance to disease, etc., etc.

Approximately 100 plant patents, covering flowers, fruits and foliage plants, have been issued to date. So far, there is little or no evidence that the issuing of plant patents has stimulated plant breeding to any noticeable extent or has resulted in the production of varieties of merit superior to those produced before the enactment of the law. In other words, the benefits have accrued not so much to horticulture as to the horticulturist in a commercial way; and that was the primary intent of the law.

Opportunities for the Future

It might seem to be an extreme statement to say that horticulture is still in its infancy, and yet a subject that has had a continuous history, as an organized science, of not more than 100 years is certainly in its early stages of development, and, therefore, full of opportunity for those who pursue it. There are new methods to be perfected, new applications to be made, new materials to be discovered, new forms to be bred, new uses to be found and a better organization to be worked out for scientific progress and for educational purposes. Graduates of Ambler have not and will not have learned a trade, but will have acquired the fundamentals of a profession which is in all the vigor of youth and correspondingly full of challenge and opportunity.

We have been passing through one of the greatest economic depressions in the world's history. Many people have been obliged to seek a new vocation to earn a living, or a new avocation to preserve their optimism, their physical health or their mental balance. For many the solution of this difficult problem has been horticulture. It is coming more and more to be recognized for its value in occupational therapy. Educators who have watched the work of the children's garden of the Brooklyn Botanic Garden have told us that the care of a garden, from seedtime to harvest, has certain educational values and possibilities that may not readily be realized in any other way. May we not expect that, in the near future, many persons who were never meant to live in a city may be taken to village or country by their love of horticulture and thus find a happy solution of their economic difficulties?

Horticulture and Culture

A great deal has been written during the past seventy-five years about the relative educational importance of the sciences and the traditional humanities. In his delightful address on "The Old Humanities and the New Science," Sir William Osler pointed out the "grievous damage" that "has been done to both in regarding the Humanities and Science in any other light than complemental." In my address at Wellesley College, in 1928, I stressed the educational and cultural importance of knowing at least the outlines of the histories of all the subjects studied. "No man is cultivated up to the standard of his generation," said Osler, "who has not an appreciation of how the greatest achievements of the human mind have been reached."

Certainly among the greatest of human achievements, we must count the domestication of animals and the beginnings and development of agriculture and horticulture. It is a commonplace of knowledge that civilization began when man began to cultivate plants. To follow the history of agriculture and horticulture in all their fascinating ramifications is to become acquainted with the essentials of human culture.

From the standpoint of the enrichment of life, what a pity it is to learn how to grow plants but learn nothing of their history and their effect on human history; to be acquainted with experiment station bulletins but never to have heard of or become acquainted with the classics of horticulture; perhaps never to have heard of even the names of those who began to establish horticulture, first as an art, and then as a science, and whose writings illuminate not only the history of gardens, but of gardeners and their contemporaries and the age in which they lived; to use such words as *yard* and *garden* and *orchard,* and even *horticulture* and know nothing of how we came to have such words, what meanings they have conveyed through the centuries, what story they tell of social manners and customs, as well as of horticulture. It isn't so much the information one misses, but the pleasure and gratification and the sense of resource and enrichment which it always gives one to know something thoroughly and to view his calling clearly because he sees it in perspective.

Professor Gilbert Murray, the beloved classical

scholar of Oxford, said recently, in connection with the celebration of his seventieth birthday, "A society without history can not understand what it is doing; and history without scholarship can not understand itself."

With equal truth it may be said that horticulture, without scholarship, without knowledge of the history of its development, can not understand itself.

My plea is for the organization of studies in all professional schools in such a way as to give education and scholarship and culture, as well as technical skill and information.

THE PURPOSE OF ANNIVERSARIES

But what is the point and purpose of recognizing an anniversary? As I have recently stated elsewhere, it is not so much to celebrate past achievement, but to reveal to the world the nature of the institution; for those in charge of it to clarify and possibly to restate their ideals in the light of the wisdom gained by past experience, and with a clear vision of future and larger accomplishments, made possible by new conceptions, new needs, new methods and techniques, new resources and new enthusiasm.

Like every institution, Ambler is the point of apparent convergence of four parallel lines—two coming down from the past, approaching, but not quite reaching the goal set twenty-five years ago; two spreading out to the future. May the School of Horticulture for Women realize a full measure of the success which is possible only by facing always forward, along the lines that diverge into a beckoning future of greater usefulness. This is what I mean by "The School of Horticulture in perspective." "Allons, mes amis, il faut cultiver nos jardins" (Come along, my friends, let us cultivate our gardens).

OBITUARY

KURT WALTER FRANKE, 1889–1936

KURT WALTER FRANKE was born in St. Paul, Minnesota, on November 17, 1889, and died at Rochester, Minnesota, on September 15, 1936. His early education was in the St. Paul public schools. Following graduation from high school he entered the University of Virginia and specialized in chemistry, receiving a diploma in analytical chemistry from that institution in June, 1912. The following four years he spent as a chemist in a company manufacturing paper and paper products.

In the fall of 1916 he reentered the University of Virginia. During 1917–18 he was an assistant in the chemistry department and held the first du Pont fellowship in chemistry at the University of Virginia during 1918–19. During 1919–20 he held an assistantship in biology. In June, 1920, the University of Virginia awarded him both the degrees of B.S. and M.S. in chemistry.

The period 1920 to 1924 he spent in industrial work, being employed as chief chemist by a large textile manufacturing company. In January, 1925, he was appointed to a Cloquet wood products research fellowship in agricultural biochemistry at the University of Minnesota, which position he held until the fall of 1926, when he was appointed instructor in the same department. In June, 1927, he received the Ph.D. degree from the University of Minnesota with a thesis entitled, "The Measurement of Hydrogen Ion Concentration in the Control of Pulp and Paper Manufacture." Immediately following the receipt of the doctorate degree he was appointed head of the department of agricultural chemistry at the South Dakota Agricultural Experiment Station at Brookings, S. D.

Upon entering into his new duties he carefully surveyed the field in order to select a line of investigation which would be of the most importance to the agricultural constituency of the state. The selected point of attack fell upon the so-called "alkali disease," an obscure malady which had seriously affected large areas of the state from time to time. This disease, which affects horses, cattle, swine and even chickens, is characterized by a decreased rate of growth, the loss of hair and an abnormal overgrowth of hoofs and nails, followed by the sloughing off of the old hoofs, leaving raw and bleeding stumps. While the disease had been known since 1860 when it was reported as a fatal disease affecting cavalry horses, Indian ponies and mules, the etiology of the disease was unknown, although commonly ascribed to the drinking of "alkali water." Relatively little careful scientific work on the disease had been published prior to Dr. Franke's attack on the problem.

Dr. Franke's training in biology and biological chemistry promptly bore fruit. He first showed that the alkali salts of the drinking water were not the causal agents. He then demonstrated that the grains and even the forages grown in the affected region were highly toxic and that feeding such grains and forages brought on the typical symptoms. He then demonstrated that in the case of the cereal grains the toxic properties were concentrated in the protein fraction and that the starch portion was non-toxic.

At about this time Dr. Franke called the attention of representatives of the United States Department of Agriculture to the extent and importance of this problem, with the result that early in 1931 a cooperative attack began upon the problem with scientists in the

Bureaus of Chemistry and Soils, Animal Industry, Plant Industry and Home Economics of the Department of Agriculture joining with Dr. Franke in the investigations. In the spring of 1931 Dr. W. O. Robison, of the Bureau of Chemistry and Soils, found in toxic wheat 10–12 p.p.m. of selenium, and he also found selenium to be present in the soils of the affected areas. Franke, by feeding selenates and selenites, was able to produce the typical symptoms of the disease so that the etiological factor was thoroughly demonstrated. His studies, however, indicated that the selenium complex in the grain was, in some instances at least, definitely more toxic than the inorganic selenates or selenites, and he accordingly turned a part of his attention to an attempt to isolate an organic selenium compound which was responsible for the toxicity. Unfortunately this work is left uncompleted, but he did adduce evidence that indicates strongly the presence of such a compound, probably one in which the sulphur of a normally occurring compound has been replaced by selenium.

In the nine years that Dr. Franke directed the chemical work in the South Dakota Agricultural Experiment Station he made a major contribution to agricultural science and accomplished far more than many men accomplish in a lifetime of endeavor. Twenty-two papers under his authorship had already appeared in print, and the experimental work on several more had been completed and manuscripts were in the process of preparation. In spite of these evidences of scientific productivity there remains considerable unpublished data and many problems which were only begun or projected.

Not only has agricultural science lost one of its most promising research workers, but those of us who knew Dr. Franke intimately feel the additional loss of a sincere and cooperative friend. He had a forceful personality, but he was always ready to contribute as much as or more than he received. His friendships were the sort that grow with time. He is survived by his wife, Louise, and a son, Royden, now a student of aeronautical engineering at the University of Virginia.

ROSS AIKEN GORTNER
UNIVERSITY OF MINNESOTA

RECENT DEATHS AND MEMORIALS

CHARLES A. WILLSON, dean of the College of Agriculture at the University of Tennessee since 1923, died on October 9 at the age of fifty-eight years.

DR. JOHN PEASE BABCOCK, formerly deputy commissioner of fisheries for British Columbia, died on October 12 at the age of eighty years.

THE death at the age of forty-nine years is announced of A. E. Clarence Smith, senior lecturer in physical chemistry at University College, Southampton, England, known for his work in photomicrography.

THE fiftieth anniversary of the beginning of the work of Dr. Charles Henry Fernald, one of the founders of economic entomology in this country and an authority in economic entomology, was celebrated at Massachusetts State College on October 16. Dr. Fernald founded the department of entomology at Massachusetts State College in 1886. He died at Amherst in 1921. Dr. W. E. Britton, state entomologist of Connecticut, presided at the formal exercises. The speakers were President Hugh P. Baker, of the Massachusetts State College; A. F. Burgess, of Greenfield, entomologist with the Federal Moth Control Laboratory, who has carried on the work of gipsy moth control begun by Dr. Fernald in 1886, and Dr. E. Porter Felt, director of the Bartlett Tree Research Laboratory, Stamford, Conn.

SCIENTIFIC EVENTS

THE MEDICAL CURRICULUM IN GREAT BRITAIN

IT is reported in *Nature* that the British General Medical Council has adopted certain resolutions in regard to professional education. These will come into operation on January 1, 1938, and include the following:

In the pre-registration requirements, it is laid down that every applicant for registration as a student by the council or for admission to the medical curriculum proper should have passed (*a*) a recognized preliminary examination in general education as laid down in the regulations of the council; and in addition (*b*) an examination or examinations conducted or recognized by one of the licensing bodies.

The subjects to be included under (*b*) are:

(1) One or two subjects of general education, other than chemistry, physics or biology, at a standard higher than that of the preliminary examination, for those who have received their instruction in these subjects before entering universities, university colleges or medical schools.

(2) Chemistry (theoretical and practical), the elementary principles of general and physical chemistry, and of the chemical combination of elements, including carbon.

(3) Physics (theoretical and practical), the elementary mechanics of solids and fluids, the elements of heat, light, sound, electricity and magnetism.

The examination in biology (theoretical and practical) may be taken either before or after registration as a student.

About a year ago a conference of representatives

nominated by the Universities of Oxford, Cambridge and London; the Royal College of Physicians of London; the Royal College of Surgeons of England and the Society of Apothecaries of London published a report on the medical curriculum which stressed the need for a continuance of the general education of intending medical students of post-school certificate stage, and therefore recommended that "the Licensing Bodies consider the possibility of allowing an encouraging exemption from the first M.B. examination by means of a higher school certificate examination conducted by any recognized examining body in which, in addition to the three principal scientific subjects, a subsidiary non-scientific subject be taken."

The higher school certificate examination is the normal objective of the post-school certificate student in public and secondary schools, and *Nature* points out that if the licensing bodies would recognize for the purpose of exemption from the second examination stated in pre-registration requirements those subjects in which a student has passed a higher school certificate examination, they will impart to the higher school certificate examination a value which has been questioned in the past by intending medical students. The recognition would also lead to greater uniformity in the education of post-school certificate students in the schools and would go a long way towards removing the evil of segregation of intending medical students from the rest of the school.

THE CONTROL OF FOREST FIRES

FOR the past fourteen years the Forest Service has been assimilating weather data that makes it possible for the ranger to determine to a certain extent the hazard of forest fires at all seasons of the year. With this information at hand and a variety of instruments he is able to estimate the probability of fires in his particular patrol and is prepared for emergencies.

According to H. T. Gisborne, senior silviculturist of the Northern Rocky Mountain Forest and Range Experiment Station, the principal factors contributing to forest-fire danger, aside from careless and indifferent human actions, are as follows: The character and volume of common forest fuels; topography, which influences the exposure of fuels and the rate of spread of fires; lightning, the one weather element that causes fire; wind, which often controls the rate of spread of fire, and current moisture content or inflammability of the fuels, which is determined principally by precipitation, temperature, humidity, solar radiation and soil moisture.

Mr. Gisborne states that the first two factors vary little from year to year, but that the third, fourth and fifth factors vary decidedly each season, even from day to day; consequently these three require daily measurement if the development of critical fire danger is to be estimated correctly, the character of each fire season rated accurately and the efficiency of the fire-control organization judged on the basis of fire danger.

Standard meteorological instruments are used in measuring weather factors by all fire-stations. This work is carried out in cooperation with the Weather Bureau. In the measurement of precipitation the standard Weather Bureau gauge, as well as a smaller Forest Service gauge, is used.

In addition to precipitation, humidity, wind and lightning, there are several other weather factors which need careful observation and accurate reporting. Haze, mist and smoke often prevent prompt discovery of fires at distant points from the lookout station. Another is the moisture content of the forest duff—the mat of dead leaves, twigs and other vegetation. The duff hygrometer, an instrument for measuring moisture content in dead vegetation, gives an accurate check on the inflammability of the material. It is possible for the forester to make a complete integration of all information from the various instruments—rain gauge, thermometer, thermograph, psychrometer, hygrothermograph, anemometer, meteorograph and duff hygrometer. From this information he can form an accurate fire-danger chart which has three major uses: (1) As a basis for localizing weather forecasts, (2) as an index of current fire-danger and (3) as a basis of fire-danger comparisons.

Mr. Gisborne points out that the value of these measurements may be offset to a great extent unless there are coordinating fire-protective regulations. In the Rocky Mountain region, such measurements are now the basis for deciding when smoking shall be forbidden within national forests, when all national forest visitors shall be required to register and obtain permits and when certain areas within national forests shall be completely closed to entry. It is desirable also that spring and fall slash burning be regulated on this basis.

THE FOSSIL CYCAD NATIONAL MONUMENT

To the two national monuments left by nature and now protected and preserved as illustrations of ancient plant and animal life, the Dinosaur National Monument of Utah and the Arizona Petrified Forests, has been added a third, the Fossil Cycad National Monument of the Southern Black Hills, of South Dakota, as a result of the work of Professor G. R. Wieland, of Yale University.

This site, in the neighborhood of the "Stratosphere Bowl" and Mount Rushmore, where the great rock carving is being carried on by Gutzon Borglum, was recognized by Professor Wieland some twenty-five years ago. Here in formations 120,000,000 years old

or more are petrified forests of cone-bearing or "flowering cycads," ancestors of present-day ferns and palms and whose solitary modern-day relative is the rare Chinese maidenhair tree.

The monument was first set aside by act of the Congress in the latter part of the Harding administration, its first inception being due to Dr. Wieland. His first step had been to file on the area under the homestead laws; his filing fees have been returned to him on the surrender of his equity so that Dr. Wieland is virtually the donor of the monument.

The cost of final development, estimated at $65,000, has thus far prevented the opening of this field botanical museum to the general public. Some excavations were carried on last year by a group of CCC young men under the direction of Dr. Wieland, who found over a ton of specimens. These were exposed to view just as they were left in their last resting place hundreds of centuries ago.

In describing the park Dr. Wieland said:

> The site offers a three-fold interest, geologic, chemical and biologic. The Black Hills are a splendidly interesting mountain knot to the geologist. Directly on the Monument and about it he may study, and students after him, the fine stratigraphic problem of the Jurasso-Cretaceous boundary. Not alone the sight-seer, but the more thoughful student, also will behold the marvelous results of "petrifaction," whereby plants of faraway dinosaur times may be again reintegrated with no detail left out. There we can see, in gemstone beauty, flowers and foliage and mature seed cones that tell much and leave us to wonder about a course of chemical change that could end in such a record. In fact, unless the chemist can repeat those changes in his laboratory he can not know fuller finality in the formation of the oolites, the cherts and the quartzose rocks generally; and he may even miss some organic relations between iron, calcium and silicon.
>
> I have estimated that adequate excavation on the cycad level, followed by development of material and its housing in a field museum, a scientific shrine, built in utter simplicity and taste to stand a thousand long years, may cost $65,000. The plan would fixedly be to house and to illustrate and display only the material in situ, so as to reach a sheer poetic simplicity. There would be reproduced in its actual surroundings a landscape of the past which would again become green and move with life as it did so far back in dinosaur times.
>
> When to take up an educational subject of deepest interest must depend firstly on available funds, and those funds must certainly in turn depend on the wealth of a country and the thrift and intelligence of its citizens. In our own country, accordingly, we find it difficult to believe that when it comes to sheer realities, the things that are surely worth while as seen through the years, we may claim either poverty or the inability to act. Or in other words if we fail to do the fine things we'll find ourselves much poorer. Therefore I urge that the Department of Parks and Monuments neither lose nor delay a single further hour in the development of the Fossil Cycad National Monument.

CHILD NEUROLOGY RESEARCH

WITH a grant from the Friedsam Foundation, a special council, with Dr. Bernard Sachs as director, has been formed to stimulate research in child neurology and allied fields. The council will consist of three neuropsychiatrists, in addition to the director, three pediatricians, one orthopedist and two laymen, who will help to decide problems of a social character. The neuropsychiatrists are: Dr. Louis Hausman, of the Cornell Medical Center and Bellevue Hospital; Dr. Foster Kennedy, of Bellevue, and Dr. Frederick Tilney, director of research of the Neurological Institute. The pediatricians are Dr. Stanley Brady, of St. Vincent's Hospital, and Dr. Howard Reid Craig, of the Babies Hospital and the Neurological Institute. The orthopedist is Dr. Lewis Clark Wagner, of the Hospital for the Ruptured and Crippled. The two laymen are William E. Grady, associate superintendent of public schools of New York, and Nathan Straus.

A statement has been made public which reads:

> With a grant from the Friedsam Foundation a special council has been formed to stimulate research in child neurology and allied fields, so that physicians and other scientists may contribute to the thorough investigation of the many problems bearing upon the care and cure of those afflicted with any of the nervous and mental disorders from birth through adolescence.
>
> The research work is to be encouraged by stipend, scholarships or otherwise. It is to be national and international in scope. The results of the work will be recorded in volumes to be issued by the council from year to year. It is hoped that the first volume will appear in the winter of 1937.
>
> The trustees of the Friedsam Foundation, of which John S. Burke is president, believe that in helping to develop child neurology research they are promoting the aims of the late Colonel Michael Friedsam, president of B. Altman & Co., who died April 7, 1931, and who was greatly interested in everything pertaining to child health and welfare.
>
> They regard child neurology research as one of the major activities of the foundation and have authorized Dr. Sachs and the council to foster original investigations in that field to the greatest extent for the benefit of medical science and the community at large.
>
> The trustees find that neurology and psychiatry have important relations to the early training of children, to development of character and to general medical and home conditions. They further agree with Dr. Sachs that the problems of child health and welfare may be properly considered to be closely allied fields for investigation.

The work on child neurology research at the Neurological Institute of New York, inaugurated by the Friedsam Foundation in 1934, has been so promising that the trustees have recognized the wisdom of extending the research beyond the limits of any one institution, city or country.

SCIENTIFIC NOTES AND NEWS

AT the convocation of the University of the State of New York on October 15, the honorary degree of doctor of laws was conferred on Dr. Albert Einstein, of the Institute for Advanced Study at Princeton. Dr. Einstein was presented by Owen D. Young, a member of the Board of Regents, and the degree was conferred by Dr. Frank P. Graves, president of the university and Commissioner of Education for the State of New York. Dr. Einstein gave an address entitled "Some Thoughts on Education."

AT the Founders Day exercises of Lafayette College, the degree of doctor of science was conferred on Dr. Donald B. Prentice, since 1931 president of the Rose Polytechnic Institute at Terre Haute, Ind. Dr. Prentice was formerly head of the department of mechanical engineering and dean at Lafayette College.

DR. WALTER B. CANNON, George Higginson professor of physiology at the Harvard Medical School, has been elected a corresponding member of the National Academy of Medicine of Buenos Aires, Argentina.

THE W. L. Saunders Gold Medal for 1937, conferred for achievement in mining by the American Institute of Mining and Metallurgical Engineers, has been awarded to Erskine Ramsay, of Birmingham, Ala., chairman of the board of the Alabama By-products Corporation. The award is in recognition of his many contributions to the invention and practical application of machines and equipment in bituminous coal mining.

HENRY METCALF HOBART, consulting engineer of the General Electric Company, Schenectady, N. Y., was awarded on October 19 the Samuel Wylie Miller Memorial Medal at the annual meeting of the American Welding Society in Cleveland, as a "pioneer and leader in a welding research movement which in nineteen years has spread to the far corners of the world and vitally affected industry."

A GOLD MEDAL "For Service to Dahlia" was presented to Dr. Marshall A. Howe, director of the New York Botanical Garden, at the annual dinner of the American Dahlia Society at the Pennsylvania Hotel on September 23. The presentation was made by George W. Fraser, president of the society.

SIR LEONARD HILL has been awarded by the Royal Society of New Zealand the T. K. Sidey Summertime Memorial Medal and Prize for 1936. This award, which consists of a gold medal and a hundred pounds, is made to the person who in the opinion of the council of the Royal Society of New Zealand has made a valuable contribution to human knowledge by original research into the effect of light and solar radiations on human comfort. The first and only other recipient of the medal is Lord Rutherford.

GENERAL JAN CHRISTIAAN SMUTS, deputy prime minister of the Union of South Africa, has been elected chancellor of the University of Cape Town in succession to the King, who held that office while Prince of Wales. General Smuts was president of the British Association for the Advancement of Science in 1931.

THE New York City Branch of the Society of American Bacteriologists, at a meeting held on October 13, elected the following officers for the year 1937: Dr. Morton C. Kahn, Cornell University Medical College, *chairman;* Dr. Ralph Muckenfuss, Research Laboratories of the Department of Health, *vice-chairman;* Professor E. J. Keegan, St. John's University, Brooklyn, N. Y., *secretary-treasurer,* and Dr. Gustav I. Steffen, New York Hospital, *councilor* to the Society of American Bacteriologists.

DR. A. S. WHEELER, professor of organic chemistry at the University of North Carolina, has retired with the title of Kenan professor emeritus.

DR. WEBSTER G. SIMON, professor of mathematics at Adelbert College and the Graduate School of Western Reserve University, has been elected to the new office of dean of the Faculties of Arts and Sciences for Adelbert and Mather Colleges and the Graduate School of the university. In the absence or disability of the president, he will have power to act in his place for the entire university. Dr. Simon has been a member of the faculty of Western Reserve since 1918 and a full professor since 1926.

DR. CHARLES H. ROGERS, since 1917 head of the department of pharmaceutical chemistry in the College of Pharmacy of the University of Minnesota, has been elected dean of the college, to succeed Dean Frederick J. Wulling, who retired last spring on reaching the age limit.

AT Columbia University the following appointments have been made: Roy R. Zipprodt, formerly regional

structural engineer for the Portland Cement Association, associate professor of civil engineering, and Dr. Robert C. Elderfield, since 1930 associated with the Rockefeller Institute, assistant professor of chemistry. Dr. Lawrence W. Sloan, lecturer in surgery in the Columbia School of Medicine, has been named assistant director of the New York Post-Graduate Medical School.

DR. F. L. CAMPBELL, senior entomologist in the Division of Control Investigations of the Bureau of Entomology and Plant Quarantine, Beltsville, Md., has resigned to become associate professor of entomology at the Ohio State University, specializing in insecticides, insect physiology and toxicology.

DR. F. H. MCCUTCHEON, formerly of Duke University, has been appointed assistant professor of zoology at the College of Agriculture and Engineering of the University of North Carolina, Raleigh. He will have charge of animal physiology. Dr. R. Harkema, until recently at Elon College, has been appointed instructor in zoology. He will have charge of animal parasitology.

MAJOR JAMES STEVENS SIMMONS, Medical Corps, U. S. Army, who in 1934 organized the Army Medical Research Board, Ancon, C. Z., and who during the past two years has been engaged in an investigation of malaria and its anopheline vectors in Panama, has been transferred for duty as assistant to the Corps Area Surgeon, Boston.

DR. CHARLES CARPENTER, formerly at the Carnegie Institute of Technology, Pittsburgh, Pa., has accepted a position as chief chemist with the Pulp and Paper Laboratory of the Industrial Committee of Savannah, Ga., of which Dr. Charles H. Herty is director.

Industrial and Engineering Chemistry states that Dr. G. Bryant Bachman, formerly assistant professor of chemistry at the Ohio State University, has joined the staff of the Eastman Kodak Company, Rochester, N. Y., as research chemist.

DR. R. W. BORGESON, formerly assistant professor of chemistry at Iowa State College, has become development director with the Fisher Scientific Company, Pittsburgh, Pa.

S. D. KIRKPATRICK, editor of *Chemical and Metallurgical Engineering*, has been elected to the board of directors of the McGraw-Hill Book Company. He is consulting editor of its chemical engineering series of texts and reference books.

AT the September semi-annual meeting of the members of the Philadelphia College of Pharmacy and Science, John S. Zinsser, president of Sharp and Dohme, Incorporated, pharmaceutical manufacturers, was elected a member of the Board of Trustees. Dean Charles H. LaWall, who has served on the college faculty for over thirty-five years, was reelected a member of the board.

THE second International Congress of Prehistoric and Protohistoric Sciences was held in Oslo, from August 3 to 9, followed by excursions lasting until the seventeenth. Thirty-six countries were represented. The delegates on the part of the United States, appointed by the Secretary of State, were: Dr. George Grant MacCurdy, Yale University, *chairman;* Dean Harriett M. Allyn (Mount Holyoke College), *secretary,* and Henry Field, Field Museum, Chicago. Dr. MacCurdy, who is director of the American School of Prehistoric Research, was a vice-president of the congress, the third session of which will be held in Budapest in 1940.

W. H. W. KOMP, entomologist of the U. S. Public Health Service, recently returned from three months spent in British Guiana, Venezuela and Trinidad, where he was engaged in mosquito studies in connection with malaria and yellow fever.

DR. DONALD F. JONES, head of the department of genetics at the Connecticut Agricultural Experiment Station, has returned from a year's leave of absence, which he spent in research at the California Institute of Technology.

DR. S. LEFSCHETZ, professor of mathematics at Princeton University and president of the American Mathematical Society, has recently returned from a summer trip in Europe, during which he lectured at the Universities of Paris, Prague, Brno and Warsaw.

THE twenty-sixth course of Lane Lectures will be given by Dr. Eugene F. DuBois, professor of medicine at Cornell University Medical College and medical director of the Russell Sage Institute, at Stanford University on April 5, 6, 7, 8 and 9, 1937. The general title of the series will be "Mechanism of Heat Loss and Temperature Regulation."

PROFESSOR H. V. WILSON, of the University of North Carolina, gave one of the A. R. L. Dohme Lectures at the Johns Hopkins University on October 12, under the title "Cell Behavior and Caenogeny—Two Points of View in the Study of Embryology."

SIR JOSEPH BARCROFT, professor of physiology at the University of Cambridge, inaugurated on October 8 the Adam M. Miller Memorial Lectureship at the Long Island College of Medicine. His subject was "The Development of Foetal Respiratory Movements." This lectureship was established in honor of the late Adam M. Miller, who was professor of anatomy from 1914 to 1935 and dean of the college from 1921 to 1935.

THE William James Lectures in Philosophy and Psychology at Harvard University are being given this year by Professor Etienne Gilson, professor of philosophy at the Collège de France and director of the Institute of Medieval Studies of the University of Toronto. The general title of the series is "The Unity of Philosophical Experience."

THE American Museum of Natural History is giving an evening course of lectures on "The World of Birds" by Dr. Robert Cushman Murphy. The series began on October 13. The dates and subjects are as follows: October 13, "The Bird's Place in Nature"; October 27, "Methods of Bird Study"; November 10, "The Geography of Birds," and November 24, "The Behavior of Birds."

THE president and council of the American Philosophical Society have authorized the holding of an autumn general meeting in the hall of the society on Independence Square, Philadelphia, on Friday and Saturday, November 27 and 28, instead of the usual stated meetings on the first Fridays of November and December. The sessions will begin at 10 A. M. on Friday and will continue throughout the day, with the usual interval for lunch and social conversation. The council will meet in executive session at 5 P. M., and a public lecture will be given in the hall of the society at 8:15 P. M. by Professor D'Arcy Thompson, of the University of St. Andrews, Edinburgh, to be followed by a reception. On Saturday, at 9:30 A. M., the members will meet in executive session. From 10:30 to 12 there will be an open session for the presentation of papers and reports.

THE twenty-sixth annual clinical congress of the American College of Surgeons opened on October 19 at Philadelphia for a week of clinical demonstrations, lectures and symposia. The program included operative clinics and demonstrations at the various Philadelphia hospitals and medical schools, evening sessions on general and special topics and conferences and symposia. Dr. Eugene H. Pool, of New York, president of the New York Academy of Medicine and president-elect of the college, was inducted into office.

SECTION I (Psychology) of the American Association for the Advancement of Science will hold its meetings on December 28, 29 and 30. In addition to the programs of submitted papers, there will be a symposium on "The Cortex and Behavior" in which a number of investigators have been invited to take part. Members and fellows of the section who wish to read papers in the general program should submit abstracts of their papers (not more than 300 words in length) by November 6 to the secretary of the section, John A. McGeoch, Department of Psychology, Wesleyan University, Middletown, Conn.

THE Division of Industrial and Engineering Chemistry of the American Chemical Society will hold a symposium at Columbia University on Monday and Tuesday, December 28 and 29. The subject will be "Absorption and Extraction." The program is well advanced, papers being equally divided between the two related topics. As has been the practice in previous symposia, the contributors are from both industrial and educational sources. Reports are expected on research carried on at the University of Birmingham, England, the Drexel Institute, the University of Illinois, the Massachusetts Institute of Technology, the Pennsylvania State College, Princeton University and the University of Virginia, as well as a number of papers from the chemical engineering staffs of leading oil companies and equipment manufacturers. There will be an informal dinner on Monday night, December 28, which will be addressed by a prominent speaker. Luncheon facilities will be provided at or near the university. The symposium for the last two years has been held at the Massachusetts Institute of Technology. In 1934 the subject was "Distillation" and in 1935 "Heat Transmission."

THE seventh annual meeting and dinner of the U. S. Institute for Textile Research will be held at the Waldorf Astoria Hotel, on Thursday, November 5. The formal meeting of the corporation for presentation of reports and election of directors will be held at 11 A.M.; a conference sponsored by the Research Council will start at 2 P.M., and the annual dinner at 7 P.M. For the conference and dinner programs are being arranged by the Committee on Meeting: W. W. Buffum, *chairman,* C. H. Clark, W. E. Emley and F. S. Blanchard. The Committee on Nominations is as follows: W. E. Emley, *chairman,* Alban Eavenson and Dr. H. DeW. Smith.

CIVIL SERVICE examinations have been announced for positions for which applications must be received before November 2 as follows: principal industrial toxicologist (heavy metals), $5,600 a year, in the Public Health Service; cereal technologist, $3,800 a year, and associate pathologist (forage crops), $3,200 a year in the Bureau of Plant Industry, Department of Agriculture; and senior medical technician (bone pathology), $2,000 a year in the Children's Bureau of the Department of Labor.

IT is reported by the Associated Press that a papal decree will be issued from the Vatican early in November announcing the establishment of a Pontifical Academy of Science. Members of the academy will not be confined to Roman Catholics provided they are not anti-religious. Pope Pius will select the first seventy members. Their successors will be chosen by themselves.

DISCUSSION

ON THE STRUCTURE OF CHROMOSOMES

THERE is no element of the cell which has excited more interest than the chromosome. It has been realized in recent years that only by the instantaneous application of the very best fixing reagents immediately to the cells can a really satisfactory insight into the organization of chromosomal structures be obtained. The smear method used on individual cells and very small organs is a result of this realization. This method, although extremely advantageous in a narrowly restricted range of cellular structures, has very serious limitations. It can not be employed on massive somatic tissues and even in the case of the reproductive elements, which frequently in the course of their development become isolated from one another in such a manner as to make possible the direct action of the best reagents, the earlier, texturally continuous stages are from the very nature of the smear method excluded from adequate fixation. Obviously a situation in cytology involving relatively few cells perfectly preserved and a large and important group representing the continuous tissues, in which good preservation is conspicuous by its absence, is undesirable and even impossible from the standpoint of clear interpretation. Conscious of this defect in our present methods, the writer has devoted a large amount of time during the past three years to the problem of the adequate fixation of the cells constituting the continuous tissues. After many failures a very simple solution of the problem has been reached which is described elsewhere. The results achieved by the improved technique have been exhibited to a number of competent cytologists both botanical and zoological and have met with general approval.

It is proposed in the present communication to give some general account of the results reached by the employment of this new procedure over a wide range of forms both animal and vegetable. It is now possible to follow in detail the behavior and organization of the chromosome in the actual divisions (mitosis) of the somatic tissues and also in the resting, preparatory and requiescent stages. These may further be compared in detail with the similar conditions in the case of the meiotic or reproductive conditions. The details of these observations and the necessary illustrations are to be published elsewhere.

When the somatic chromosomes have reached a certain size in proceeding from the resting condition to mitosis, they are clearly seen to be made up of a matrix, around the outside of which are coiled two filaments or chromatids spiralling in opposite directions, in such a manner that the gyres or coils of them cross one another, often presenting the optical illusion of a series of particles or chromomeres, which in recent years have been interpreted by some as the loci of the genes. The spirals tend to straighten out as the nucleus passes into the metaphase and the spirals as a consequence, in parts of the chromosomes at any rate are often obliterated. In the later stages of the metaphase the two chromatids or filaments present in each chromosome lose completely their curled character and come to lie parallel side by side. At this stage and even earlier the two daughter filaments of the metaphase or even the prophase chromosomes, clearly separate from one another and each in turn become double, as in the mother chromosomes. At this stage and still more in the anaphase of mitosis these newly formed chromatids or filaments are strongly coiled around one another in reverse directions. Thus in later metaphase there are clearly present four filamentous elements in each metaphase chromosome, precisely as has been described recently for the meiotic metaphase studied by the smear method. As the anaphase sets in and verges towards the telophase, the spirals in its chromosomes become more or less obscured by contractions. As the chromosomes emerge from the telophase, their two filaments or chromatids are again quite obvious. The spirals become even broader and shorter and thus pass into the resting stage. With the onset of the prophases of the next division the two filaments in each chromosome are again established and are at first very narrowly twined in the slender chromosomes. These become thicker and thicker and the pair of chromatids or filaments become more pronounced and spirally wound in reverse. With the onset of the metaphase the same situation as described above repeats itself.

The course of events in the case of the meiotic or reproductive chromosomes is closely similar; a striking contrast, however, is presented in the halved number of chromosomes, long known to be typical of normal meiosis. Apart from their halved number and corresponding larger size the chromosomal events in meiosis in general present a very close resemblance to that described in the preceding paragraph for the divisions of the somatic or body cells (mitosis). The same spiralization of the chromatids or chromonemata is seen, and in many cases—for example, Allium, Lilium and Vicia, classic objects for the investigation of the reproductive or meiotic divisions—the spirals are in reverse directions, precisely as in the case of the somatic (mitotic) divisions. A striking contrast in this respect, however, is presented by species of Tradescantia and Trillium, as described recently by Sax, Huskins and Matsuura, and confirmed in part

the present writer. Here the paired filaments or romonemata of the individual chromosomes are iral but run parallel to one another. Thus in cer- n cases the reproductive chromatids or chromo- mata are contrasted with the somatic ones by the t that they run parallel instead of in opposite di- tions. The present author has found the parallel ndition to be present in the gametophytic soma of ecies of Trillium.

The situation outlined in the foregoing paragraphs ems to set the whole cytological situation in the matic (mitotic) and reproductive (meiotic) divisions a new light and establishes if confirmed by other servers a much closer resemblance between the two an has in the past been realized. The mode in which e contrast in chromatidal behavior between repro- ctive and somatic elements in Trillium and Trades- ntia, etc., is achieved still remains to be elucidated. It is worth while to add perhaps that the present urse of investigation, which covers not only plants t a considerable number of animals, serves to set in lief the great superiority of good vegetable objects, ch as Tradescantia, Trillium, etc., over the tailed mphibia, such as Amblystoma, Necturus and Crypto- anchus, for the fundamental study of the chromo- mes. Apparently, however, the same general chro- osomal conditions prevail in the two great divisions living beings.

EDWARD C. JEFFREY

HARVARD UNIVERSITY

JUNE 16, 1936

THE ROLE OF KINESTHESIS IN MAZE LEARNING

FROM the results of an early investigation by Wat- on[1] in 1907 the idea prevailed for some time that the nly sense indispensable to maze learning in rats is he kinesthetic. However, in 1929 Lashley and Ball[2] emonstrated that the elimination of kinesthetic im- ulses by means of spinal sections did not abolish the erfected maze habit. Evidence showing that kin- sthesis was unnecessary to the *learning* of the maze abit was soon forthcoming when Ingebritsen[3] demon- trated learning in rats that were deprived, prior to raining, of kinesthetic impulses by sectioning of the ervical cord. Thus, kinesthesis was found unneces- ary not only to the perfected habit but also to the earning of the habit.

There is now evidence that if all senses but the inesthetic are abolished maze learning in rats is im- ossible. Previous tests by the writer had shown that the senses of vision, olfaction and audition, but not the tactual sense, play a rôle in maze learning, and it was therefore necessary only to render a group of rats blind, deaf and anosmic, but not tactually anesthetic, in order to show whether or not learning is possible when only the kinesthetic sense remains. A group of 45 blind-deaf-anosmic rats trained on a 14-blind elevated maze showed no signs of learning after 22 days of training (44 trials on the maze). The performance of these animals, measured by entrances into blinds, at the end of training was no whit better than the performance on the first trial; the performance of the group on the 22nd day was a "chance" performance.

It may be concluded, therefore, that not only is kinesthesis unnecessary both to learning and to the perfected habit, but that learning on the basis of kinesthesis alone is impossible. The evidence against kinesthesis would seem to be overwhelming. Far from being the one indispensable sense, kinesthesis appears to have no rôle whatever in the acquisition of the maze habit. But this conclusion, in view of other facts, would be hazardous. The smooth functioning of a well-learned motor habit or skill no doubt has in it a large kinesthetic element. It has been assumed that each movement in such a habit furnishes the stimulus for the succeeding movement, and that the smooth succession of movements is due to the close chaining of movements made possible by movement-produced stimuli. Our evidence shows, however, that the close chaining is possible only after the correct order of movements is learned on the basis of other classes of stimuli. Kinesthesis, in other words, seems to be essential to the acquisition of skill, that is, to the smooth flowing of movements, but this function it can assume only in conjunction with other classes of stimuli and only after learning has begun on the basis of other stimuli. Though Ingebritsen's animals learned the maze it is improbable that they could ever run through it with the speed and skill possible to normal rats.

C. H. HONZIK

UNIVERSITY OF CALIFORNIA

THE DATES OF PUBLICATION OF THE EARLIER NEW YORK STATE MUSEUM REPORTS

THE assertion has been repeatedly heard by members of the museum staff that the dates of publication of the earlier museum reports and bulletins are not reliable.

A typical case came to the writer's attention in connection with the catalogue of Devonian types now under preparation. The question of the priority of the term *Dolichocephala lacoana* Claypole, over *Stylonurus excelsior* Hall, which has been claimed by Beecher (1900) and others, came up. Investigation

[1] J. B. Watson, *Psychol. Rev. Monog.*, 7: 2, 1907.
[2] K. S. Lashley and J. Ball, *Jour. Comp. Psychol.*, 71-106, 1929.
[3] O. C. Ingebritsen, *Jour. Comp. Psychol.*, 14: 279-294, 1932.

has proven that Claypole's paper was read before the American Philosophical Society on September 21, 1883, and printed on November 2, 1883.

Hall submitted his paper in his thirty-sixth annual report to the Senate on January 12, 1883 (see Senate document 53). This Senate document, in which Hall's paper with figures is printed, had according to law (Law 1859, Chapter 437) to be printed and distributed before the end of the year. The printer, however, was wont to deliver the Senate documents before the end of the fiscal year, which then was September 30, in order to receive payment, and the bills of the year 1883 show that he also did so that year. That means that copies of the Senate documents with Hall's paper included were distributed before October. A separate reprint of Hall's thirty-sixth report was published and distributed in 1884. This report bears the date 1883 on the title page and that of 1884 on the paper cover. Furthermore, he also had still a reprint of his paper on Stylonurus distributed in 1884. These facts have led to the erroneous conclusion that Hall's paper was not in print until 1884, when as a matter of fact it was in print in Senate document 53 sometime in the summer of 1883, long before Claypole read his paper.

This typical case serves to explain numerous cases of doubt of the proper date of publication of the New York State reports. It has been even suggested that Hall dated his publications ahead. The fact is that the date of publication of many of our earlier museum reports and bulletins is the date of the Senate document, in which they first appeared. This is the date on the title page. Reprints which were often widely distributed bear later dates, but those are not the dates of first publication.

RUDOLF RUEDEMANN

NEW YORK STATE MUSEUM

A NEW WORD

IN the issue of SCIENCE for September 25, 1936, page 291, Dr. Robert T. Morris suggests that a new word might be useful, similar in form to benthos, nekton, plankton, etc., to designate the more or less organic mud of *shallow* bottoms on which various fishes, mollusks, birds and other animals feed. Why not "ilyon," from the Greek ἰλύς,-ύος, meaning mud or slime? With various appropriate suffixes, one might speak of "ilyonic" food, of animals living in the bottom mud as "ilyobic" or of those that feed on it as "ilyophagous." If the simple word "mud" is not clean enough, the new term would have to be more accurately defined to meet the requirements of ecological description.

GLOVER M. ALLEN

CAMBRIDGE, MASS.

SCIENTIFIC BOOKS

THE PHILOSOPHY OF MATHEMATICS

Mathematics and the Question of Cosmic Mind and Other Essays. By CASSIUS J. KEYSER. Scripta Mathematica Library No. 2.

THE welcome effort of the Scripta Mathematica Library to encourage discussion of the philosophical and cultural aspects of mathematics is continued in this booklet, which contains some of Professor Keyser's essays collected from various sources. These essays, written clearly and enthusiastically, aim to explain several phases of mathematics to those laymen "who live to think and who are not satisfied with being merely told."

The first three essays form a sequence leading to the question suggested in the title of the book. First, the nature of mathematics is analyzed in terms of its method, which is taken to be strictly postulational. In other words, a mathematical doctrine starts with certain undefined primitive terms, which are really variables, and with a certain number of consistent axioms, and proceeds by defining new terms by means of the primitive ones and by deducing new statements from the axioms. This abstract concept of mathematics is explained vigorously and lucidly. However, some mathematicians might consider this identification of mathematics with postulational thinking to be incomplete. Does mathematics start with any old system of postulates whatever or does it content itself with any arbitrarily chosen deductions from a given set of postulates? Does the postulational approach account for the fact that, historically, mathematics consists of the elaborate development of a few particular postulate systems? How can the all-important consistency of these postulate systems be abstractly established, especially when Gödel has indicated the great difficulty of formal consistency proofs?

The second essay engagingly explores the "Bearings of Mathematics"—"a certain rich manifold of light-giving relations connecting mathematics with those great human interests . . . in which there is, properly, no question of establishing mathematical propositions." Such relations concern the art of exposition, the universality of the mathematical concepts of change and invariance and the ideal of logical rectitude.

The title essay then reviews the light which mathematics can throw on the question, "Is the world essen-

tially a world of mind, or spirit, or soul?" Professor Keyser recognizes that mathematics alone can not definitely answer this question, but he does exhibit a number of quotations from famous mathematicians who tend to believe that the world is a realm of mind.

In the course of these essays Professor Keyser also presents a challenging definition of science. He says that science has for its characteristic aim "the establishment of categorical propositions in answer to questions about the actual world," while, in sharp contrast, mathematics essentially aims "to establish hypothetical propositions in answer to questions regarding the logically possible." He then explains how a mathematical doctrine can be applied to science by replacing the variable primitive terms by constants and by verifying the resulting postulates. The question arises whether such a definition adequately allows for a sophisticated science, such as physics, where we never verify the postulates but only the results of complicated deductions from the postulates.[1]

The other essays include an eloquent eulogy of the American mathematician, philosopher and poet, William Benjamin Smith, a discussion of the use of mathematics in legal science and a forceful plea for the popularization of science, "to mitigate the tragedy of our modern culture." This tragedy, the author takes to be the inability of ordinary intellectually curious people to understand the important implications of mathematics and science. From this point of view, the great art of popularizing science and mathematics is explained. Indeed this booklet is itself an illustration of that art.

Humanized Geometry, An Introduction to Thinking. By J. HERBERT BLACKHURST, Iowa University Press. 1935.

THIS text-book offers an extremely suggestive and illuminating presentation of high-school geometry. The author is not content with the routine presentation of geometrical proofs; rather he aims "to utilize geometry as a resource in exposing and studying the processes of thinking." Consequently throughout the text he discusses with the student the nature and function of the logical methods used and the possibility of applying these methods to non-mathematical thinking.

For example, the theorem on the equality of vertical angles is first established inductively from measurements in particular cases and only subsequently by a deductive proof. Then the author discusses the errors in measurement present in such inductive proofs and in other parts of science and contrasts this method with the deductive method. There follow some historical remarks on the discovery of the deductive method by the Greeks. The whole discussion consciously aims to help the student understand what deductive "proofs" really accomplish.

Throughout the book the formal treatment of geometry is supplemented by similar discussions: On the nature of abstract thinking, on the disadvantages of memorizing geometry, on the analytic method of finding proofs for theorems, on the syllogism and on fallacies. The author points out the importance of formulating the premises on which an argument rests, and remarks on the danger of the tacit assumptions made in every-day life. Again he considers the ways in which we can solve geometrical problems, compared with the difficulty in solving social problems, and he emphasizes the undesirability of accepting ready-made solutions for such social problems. These discussions should succeed in making the methods of effective thinking interesting to the student.

The geometry itself includes the usual theorems now required in plane geometry (some of the harder ones are placed in an appendix), together with a few sample theorems of solid geometry. The applications of geometry are kept in mind throughout. For instance, similar polygons are introduced in connection with photographic images. Many amusing practical problems are included. Finally, there is a long and excellent section on "Geometry in Art and Practical Affairs."

The formal logic applied by the author is strictly Aristotelian. It seems to the reviewer that some of the more modern logical ideas might have been illustrated in the discussions, especially in connection with definitions, where the genus-species analysis used by the author should be supplemented by the remark that definitions must always explain the unknown in terms of the known. The discussion of necessary and sufficient conditions in locus problems is weak. The treatment of limits is shaky; at one point it is argued that the perimeter of regular polygons inscribed in a circle increases with the number of sides and is always less than the circumference and that *therefore* (!) the perimeter approaches the circumference as a limit. In another place the elementary trigonometric functions are introduced before the logically prerequisite properties of similar triangles have been developed.

These weaknesses (most of them are not original with the author) do not essentially mar the real contribution of this book—a vigorous attempt to rescue geometry from possible desuetude by showing that it can be taught so as to be a real training in effective thinking.

SAUNDERS MAC LANE

CORNELL UNIVERSITY

[1] See H. Weyl, "Philosophie der Mathematik und der Naturwissenschaft," pp. 111–123.

SPECIAL ARTICLES

PERFECTION AND AGGLOMERATION OF CRYSTALLINE PRECIPITATES ON AGING

IN extensive studies on the aging of freshly precipitated lead sulfate prepared from 0.1 molar lead nitrate and 0.1 molar potassium sulfate at room temperature we[1] arrived at the conclusion that the classical type of aging, the so-called Ostwald ripening, is of subordinate significance at room temperature. When dealing with a heterodisperse precipitate the Ostwald ripening involves the solution of the smaller particles and the growth of the larger particles at the expense of the small ones. Recent studies carried out in this laboratory on the aging at room temperature of barium sulfate[2] and of silver chloride,[3] details of which will be reported in the *Journal* of the American Chemical Society, have substantiated the above conclusion. The fresh precipitates, although crystalline, are highly imperfect, as indicated by the diffuseness of the x-ray lines. Especially during the early stages of aging in the mother liquor a very fast perfection process occurs as a result of recrystallization without *always* being accompanied by pronounced changes of the external surface (Ostwald ripening). It was found that all factors which decrease the solubility of the precipitate inhibit the speed of perfection, and hence of recrystallization; on the other hand, all factors which increase the solubility promote recrystallization and perfection. It was concluded that this recrystallization occurs in a liquid film around the primary particles. The surface of the latter is very irregular and contains spots of various activities. At these spots ions quickly enter into the liquid film, the solution being supersaturated with regard to the more normal surface, on which the ions redeposit. This process occurs so quickly that the lattice ions, in excess in the supersaturated film, hardly have an opportunity to enter the bulk of the solution and cause Ostwald ripening. The above recrystallization, therefore, results in a self-digestion and self-perfection of the primary particles. ***The speed of perfection is not determined by the solubility of the precipitate in the bulk of the solution but by the solubility in the liquid film around the particle.*** Thus, it was found by Noponen[2] that barium sulfate ages much faster in 0.005 m sulfate than in 0.005 m barium solution, although the solubility of the precipitate in both solutions is of the same order. The difference is attributed to the fact that barium ions are adsorbed much stronger on the fresh precipitate than sulfate ions. Consequently, the solubility of the barium sulfate in the liquid film around the particles is much smaller in 0.005 m barium than in 0.005 m sulfate. In studies by Yutzy[3] with freshly precipitated silver chloride it was found that the aging is much more pronounced in 0.001 m chloride than in 0.001 m silver. In interpreting this result it should be realized that silver halides have a pronounced tendency to adsorb their own ions, the halide ions being more strongly adsorbed than silver ions. Thus, the concentration of the adsorbed chloride ions in the solvated jacket around the particle may be much greater than in the bulk of the solution and may give rise to the formation of the complex $AgCl^-_2$ ions with the silver chloride. It is well known that the solubility of silver chloride in more concentrated chloride solutions is greater than in water, owing to formation of complex argento-chloride ions. If the concentration of the adsorbed chloride ions in the liquid film is great enough, the solubility of the silver chloride in the liquid jacket may be much greater than in the bulk of the solution, thus accounting for the more rapid aging of silver chloride in 0.001 m chloride than in 0.001 m silver or in pure water. So far, we have only considered the perfection of the individual particles. This process may be accompanied by an agglomeration. Various primary particles may share their water jackets and thus form loose agglomerates which can be easily peptized again. When the perfection process occurs in such an agglomerate, lattice ions may be deposited in the liquid canals between the particles, thus cementing them together by the formation of bridges consisting of lattice material. When the entire liquid space is filled up with lattice material, the crystalline aggregates will have a mosaic structure. The cementing process is irreversible and results in a decrease of the total surface of the precipitate as measured by the adsorption of a suitable dye. Factors which promote the perfection process will also promote the cementing process. It was found, for example, that no cementing occurred upon the slow aging of barium sulfate in a solution containing an excess of barium, but a very pronounced one upon the aging in excess of sulfate.[2] Also, the aging of silver chloride in an excess of chloride and even of silver is accompanied by a pronounced cementing process.

The above short review does not give a complete

[1] I. M. Kolthoff and Ch. Rosenblum, *J. Am. Chem. Soc.*, 56: 1264, 1658, 1934; 57: 597, 607, 2573, 2577, 1935; 58: 116, 121, 1936.

[2] G. E. Noponen, Thesis, 1936, University of Minnesota.

[3] H. Yutzy, Thesis, 1936, University of Minnesota.

insight into the complex mechanism of the aging, and more work is being done to investigate various phenomena and to experimentally test the interpretations presented.

I. M. KOLTHOFF

UNIVERSITY OF MINNESOTA

UTERINE RESPONSE TO DIHYDROTHEELIN[1]

IT has been observed for many years that the estrogenic hormones from any source caused a considerable thickening in the epithelium of the vagina and the development of a cornified layer of epithelium in experimental animals. Stockard and Papanicolaou[2] noted this while working with guinea pigs in 1917. Allen and Doisy[3] used this observation to develop a simple test for the estrus condition—namely, the vaginal smear method. Since then the method has been refined by various workers and is widely used. Fee, Mirian and Parkes,[4] Zondek[5, 6] and others have shown that estrogenic substances cause marked hypertrophy of the uterus and early vaginal introitus in immature females.

Dorfman, Gallagher and Koch[7] have suggested that quantitative observations on the hypertrophy of the uterus be used to distinguish between the estrogenic compounds. Twenty-five day-old rats were injected daily for five days with the assayed estrogenic substance. They were then sacrificed, and weights of both the uteri and the ovaries were determined. The ratio of uterine weight (mg) to animal body weight (gm) less the gut was plotted against the dosage in rat units. Theelin and theelol compared in the same way showed a marked difference in their effects upon uterine growth.

Ralls and Jordan,[8] D'Amour and Gustavson,[9] Thayer, Jordan and Doisy[10] and later MacCorquodale, Thayer and Doisy[11] have reported the presence of an estrogenic compound in the follicular fluid of the ovary. Using its properties as a basis of opinion the latter named authors suggested that the reported compound was dihydrotheelin.

As was stated above, Dorfman, Gallagher and Koch,[7] suggest that the uterine response is a good test method to distinguish between the various estrogenic compounds. It was decided to compare the standardized international theelin and dihydrotheelin in this respect. The technique used was that suggested by D'Amour and Gustavson,[12] theelin assayed 0.84 γ per rat unit; dihydrotheelin assayed 0.154 γ per rat unit. These preparations were incorporated in olive oil for injection. Olive oil was injected in controls. Litter mates were selected for each test. Dosages of .05, .1, .2, .3, .4, .5 and .6 rat units were used. The number of animals receiving dosage for each substance varied from three to ten.

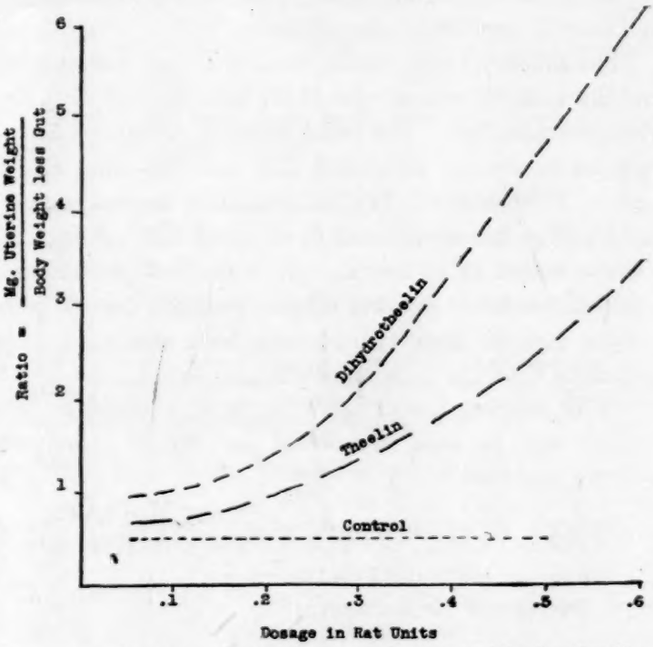

FIG. 1. Uterine response to theelin and dihydrotheelin.

By reference to Fig. 1, it can be seen that dihydrotheelin had a much greater effect upon hypertrophy of the uterus than theelin did. This is considered reasonable upon the basis of relative activity of the two as reported by several workers.

H. W. MARLOW

KANSAS STATE COLLEGE

THE VITAMIN C CONTENT OF THE HUMAN TONSIL[1]

THE tonsils of 54 persons, mostly children, were analyzed for vitamin C on the day of operation by the method used for foods by Birch, Harris and Ray.[2] Values ranged from 10.6 to 47.6 milligrams per 100

[1] Contribution No. 221, Department of Chemistry, Kansas State College.

[2] C. R. Stockard and G. N. Papanicolaou, *Am. Jour. Anat.*, 22: 225, 1917.

[3] E. Allen and E. A. Doisy, *Jour. Am. Med. Assoc.*, 81: 819, 1923.

[4] A. R. Fee, G. F. Mirrian and A. S. Parkes, *Jour. Physiol.*, 67: 377, 1929.

[5] B. Zondek, *Nature*, 133: 209, 1934.

[6] B. Zondek, *Nature*, 133: 494, 1934.

[7] R. I. Dorfman, T. F. Gallagher and F. C. Koch, *Endocrin.*, 19: 33, 1935.

[8] J. C. Ralls and C. N. Jordan, *Endocrin.*, 10: 273, 1926.

[9] F. E. D'Amour and R. G. Gustavson, *Jour. Pharm. and Exp. Therap.*, 49: 141, 1935.

[10] S. A. Thayer, C. N. Jordan and E. A. Doisy, *Jour. Biol. Chem.*, 79: 53, 1928.

[11] D. W. MacCorquodale, S. A. Thayer and E. A. Doisy, *Proc. Soc. Exp. Biol. and Med.*, 32: 1185, 1935.

[12] F. E. D'Amour and R. G. Gustavson, *Jour. Pharm. and Exp. Therap.*, 40: 473, 1930.

[1] Preliminary report.

[2] T. W. Birch, L. J. Harris and S. N. Ray, *Biochem. Jour.*, 27: 590, 1933.

grams of tissue. The mean for the entire group was 24 milligrams, with a standard deviation of 6.4 milligrams.

Estimates were made of the vitamin C content of the diets which the patients had been receiving prior to operation and the results suggested a relationship between the vitamin C content of the diet and that of the tonsils.

In order to further study the effect of the vitamin C content of the diet and to determine how much vitamin C the tonsil tissue is capable of taking up 3 children (ages 3 to 6), who were hospital patients convalescing from infectious diseases and who were to have their tonsils removed, were given 400 cubic centimeters of orange juice daily for periods of from 5 to 12 days before their operations. The tonsils of these children contained an average of 42.9 milligrams of vitamin C per 100 grams of tissue.

The urinary excretion of vitamin C was determined in the case of one of the above children on the day before operation. The child received 200 cubic centimeters of orange juice at 8 A.M. and 200 more at 10 A.M. This amount of juice contained approximately 240 milligrams of vitamin C, of which 140 milligrams was excreted in 24 hours. Since this patient had received this same amount of orange juice for 11 previous days his tissues must have been saturated with vitamin C at the time of operation.

It is suggested that the vitamin C content of the tonsils may be used to indicate the vitamin C content of the tissues.

MARY M. CLAYTON
JOHN D. KEITH

SCHOOL OF MEDICINE AND DENTISTRY
UNIVERSITY OF ROCHESTER

CYTOGENETIC NOTES ON COTTON AND COTTON RELATIVES. II

CONSIDERABLE effort has been made to produce hybrids between morphologically distinct groups of *Gossypium* with a view of determining their phylogenetic relationships through cytological behavior. Recently hybrids between (1) wild species of *Gossypium* and between (2) wild and cultivated cottons have been described,[1,2,3] but their meiotic behavior has been reported in only a few cases.

The present note deals with F_1 hybrids involving: (1) cultivated American species; (2) cultivated Asiatic species; (3) wild American species; (4) a wild Asiatic species, *Gossypium Stocksii* M. Mast.; (5) a wild African species, *G. anomalum* Wawra and Peyr.; (6) a wild Australian species, *G. Sturtii* F. v. M.; (7) *Thurberia thespesioides* A. Gray, a wild American plant, closely allied to *Gossypium*. Each of these groups, with one exception, has the haploid chromosome number 13; in the cultivated American group the haploid number is 26.

This is the first cytological report on the hybrids discussed below; most of which represent hitherto unreported combinations between groups. The chromosome complement at the reduction division is generally composed of: (a) 13 pairs in hybrids between cultivated Asiatic species and *Gossypium anomalum*, and in hybrids between wild American species and *Thurberia thespesioides*; (b) 13 pairs and 13 single chromosomes in hybrids between cultivated American species and *Thurberia thespesioides*, and in hybrids between cultivated American species and *G. anomalum*; (c) from 0 to 8 pairs with from 10 to 26 single chromosomes in hybrids between cultivated Asiatic species and *G. Stocksii*, and between cultivated Asiatic species and *G. Sturtii*; (d) 26 single chromosomes in hybrids between cultivated Asiatic species and *Thurberia thespesioides*.

Since the haploid complements of *Thurberia thespesioides* and the wild American species are cytologically homologous, and those complements of *Thurberia thespesioides* and the cultivated Asiatic species are not homologous, we may assume that the complements of the wild American species and the cultivated Asiatic species are likewise non-homologous. Hence, the above findings give support to Skovsted's assumption that the cultivated American cottons were derived from a cross between a wild American species and a species having a chromosome complement similar to that of the cultivated Asiatic cottons.[4] The fact that the complement of *Thurberia thespesioides* is cytologically homologous with the complement of wild American species and with a part of the complement of the cultivated American species strongly supports the view that *Thurberia thespesioides* is congeneric with *Gossypium*.

J. M. WEBBER

BUREAU OF PLANT INDUSTRY
U. S. DEPARTMENT OF AGRICULTURE

[1] A. Skovsted, *Jour. Gen.*, 30: 397–405, 1935.
[2] A. Skovsted, *Jour. Gen.*, 30: 447–463, 1935.
[3] J. M. Webber, *Jour. Agr. Res.*, 51: 1047–1070, 1935.
[4] A. Skovsted, *Jour. Gen.*, 28: 407–424, 1934.

BOOKS RECEIVED

Bailey's Textbook of Histology. PHILIP E. SMITH, Editor. 9th edition. Pp. xvi + 773. 506 figures. Williams and Wilkins. $6.00.

BISHOP, A. H. B., and G. H. LOCKET. *An Elementary Chemistry.* Pp. 401. 133 figures. Oxford. $1.75.

MORSE, PHILIP M. *Vibration and Sound.* Pp. xv + 351. 88 figures. 3 plates. McGraw-Hill. $4.00.

MOTT, N. F. and H. JONES. *The Theory of the Properties of Metals and Alloys.* Pp. xiii + 326. 108 figures. Oxford. $8.00.

STEPHENS, D. OWEN. *Flow of Horizons.* A book on evolution. Pp. 190. Illustrated. John Day. $2.50.